

GRAPHICAL SOLUTION

(12 Marks)

Q: $y = x^2 + 7x + 4$
 $(-2)^2 + 7(-2) + 4$

(i) Complete the table below: (1 Mark)

x	-2	-1	0	1	2	3
y						

LIFE SAVING TIP: Always use brackets while putting values in any equation.

$$\frac{-2^2 + 7(-2) + 4}{84}$$

↓ This is wrong.

$$-14$$

$$(-2)^2 + 7(-2) + 4$$

↓ This is correct.

$$-6$$

(ii) On a graph draw a smooth curve. (3 Marks)

Lets break these three Marks:

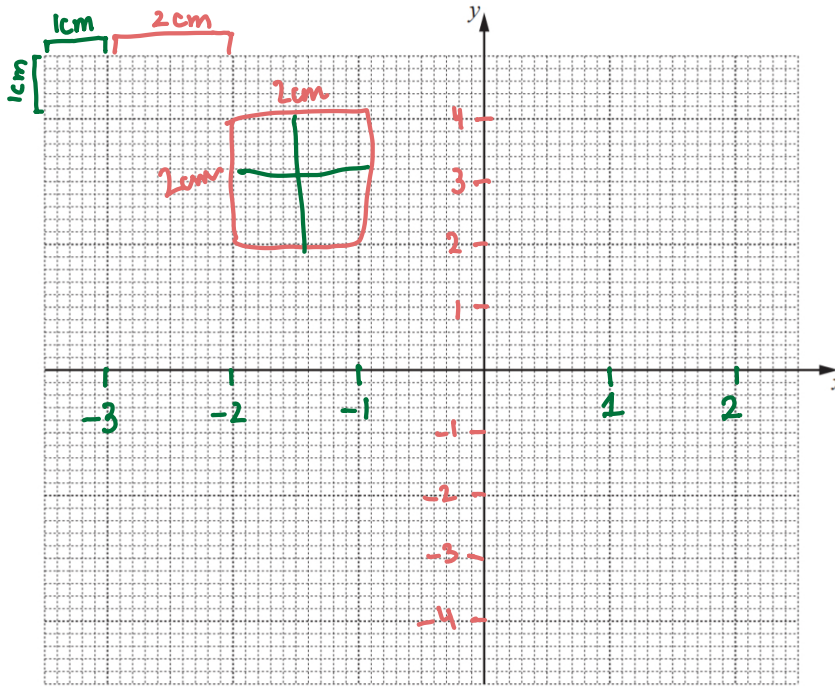
1 Mark Scale.

On horizontal axis 2cm represents 1 unit

1cm represents 1 unit.

5 Small boxes = 1 cm 10 Small boxes = 2 cm

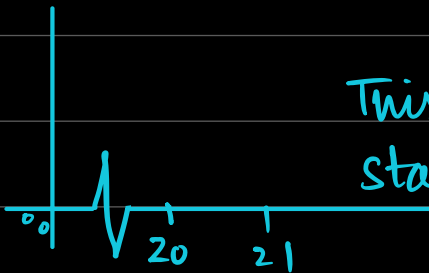
- (a) Using a scale of 2 cm to 1 unit on the x-axis for $-3 \leq x \leq 2$ and a scale of 1 cm to 1 unit on the y-axis for $-4 \leq y \leq 4$, plot the points from the table and join them with a smooth curve.



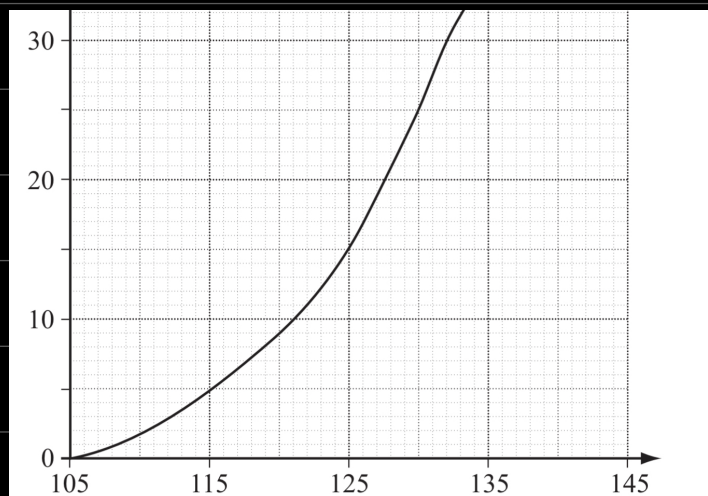
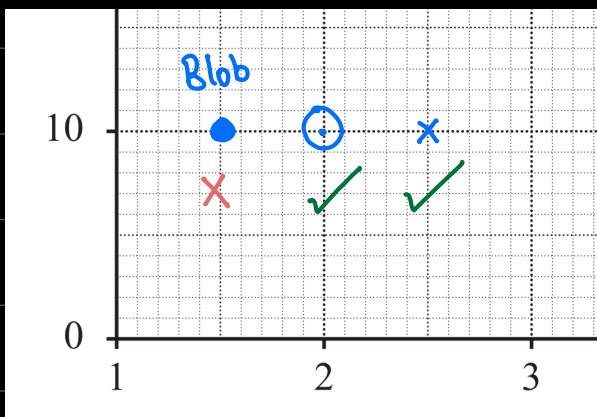
↓
This applies to
all subjects
with graphs.

THIS IS NOT
ALLOWED IN
CAIE

Sometimes the scale does not start from zero.



This is wrong way of
starting from another value.



IMARK

PLOTS

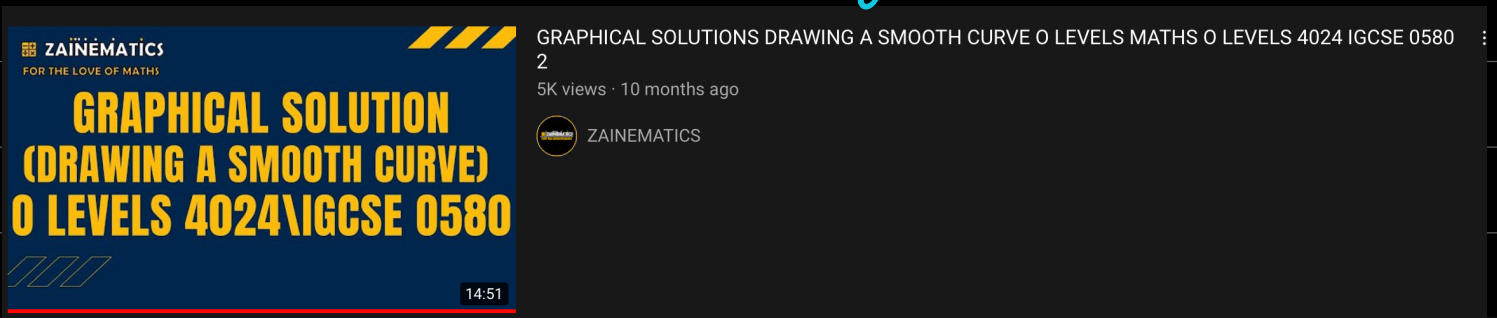
⊙ or x
↓
we prefer
doing this.

Do not make a thick dot.

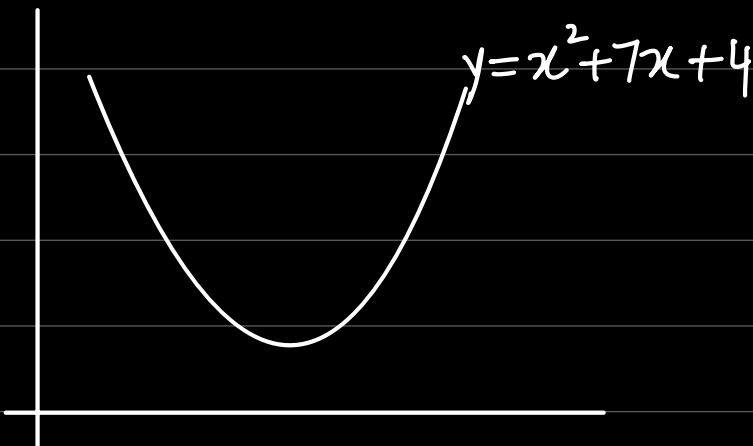
1 Mark Smooth curve.

Three main Basics:

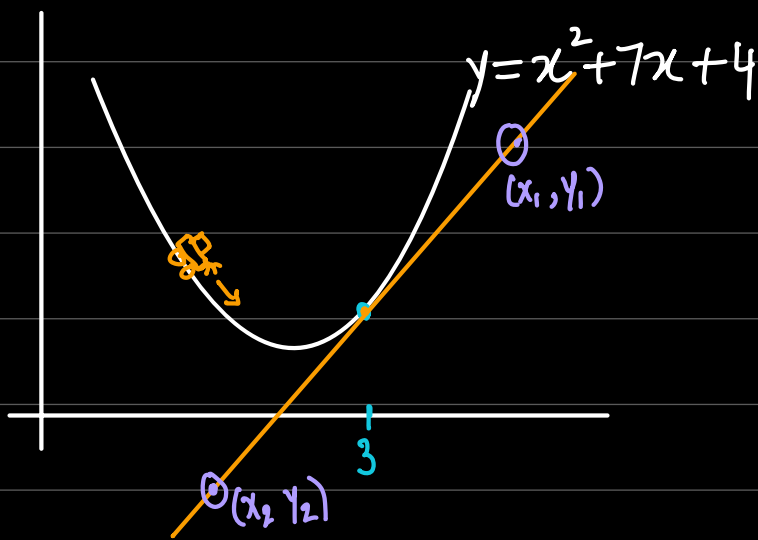
- a) Pencil grip
- b) Hand direction
- c) 5 times fake draw.



Now you will have a graph which may look like this:



(iii) By drawing a tangent to curve at $x=3$, find gradient of curve. (2 Marks)

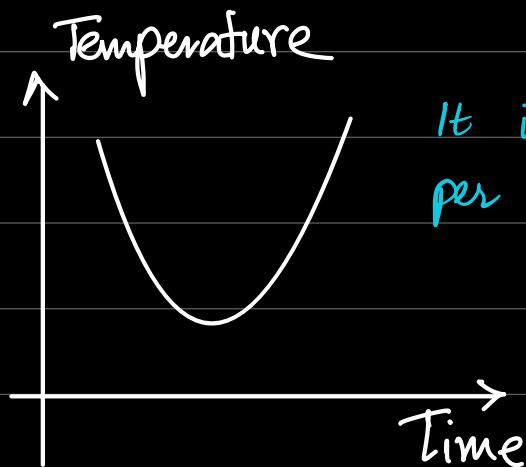


Steps to make a good tangent

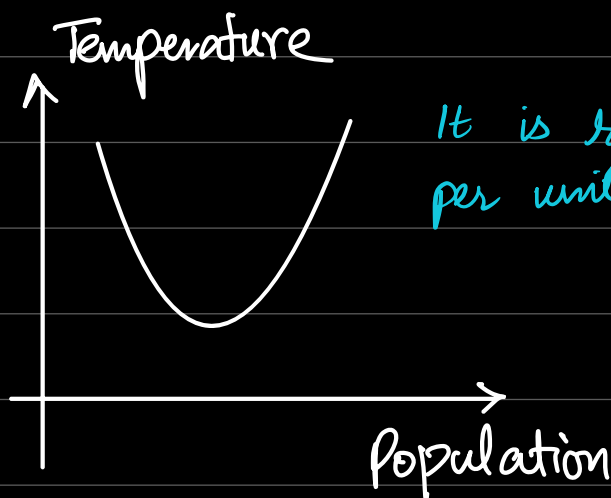
- 1) Gari wali example
Tangent and curve must point in same direction at that point.
- 2) LONGER TANGENTS ARE BETTER.
- 3) Choose two points on tangent FAR AWAY
- 4) Find gradient
$$\text{grad} = \frac{y_2 - y_1}{x_2 - x_1}$$

(iv) What does this gradient represent? (1 Mark)

It is rate of change of y -axis quantity
per unit change in x -axis quantity.



It is rate of change of $\overset{\text{y-axis quantity}}{\text{Temperature}}$ per unit change in $\overset{\text{x-axis quantity}}{\text{Time}}$.



It is rate of change of $\overset{\text{y-axis quantity}}{\text{Temperature}}$ per unit change in $\overset{\text{x-axis quantity}}{\text{population}}$.

HERE ONWARDS, ALL PARTS ARE DIVIDED IN TWO MAIN CASES:

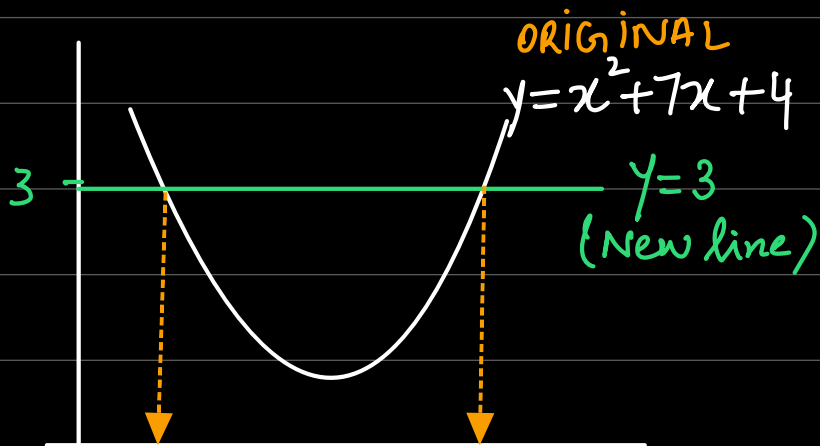
CASE 1

KEYWORDS:

SOLVE

FIND THE SOLUTIONS

(v) Using the graph, **solve** $x^2 + 7x + 1 = 0$ (1 Mark)



$$\begin{array}{r}
 x^2 + 7x + 1 = 0 \\
 \checkmark \quad \checkmark \quad +3 \quad +3 \\
 \hline
 \underbrace{x^2 + 7x + 4}_{\text{original}} = 3
 \end{array}$$

Ans

Ans -

$$y = 3$$

plot this on graph.

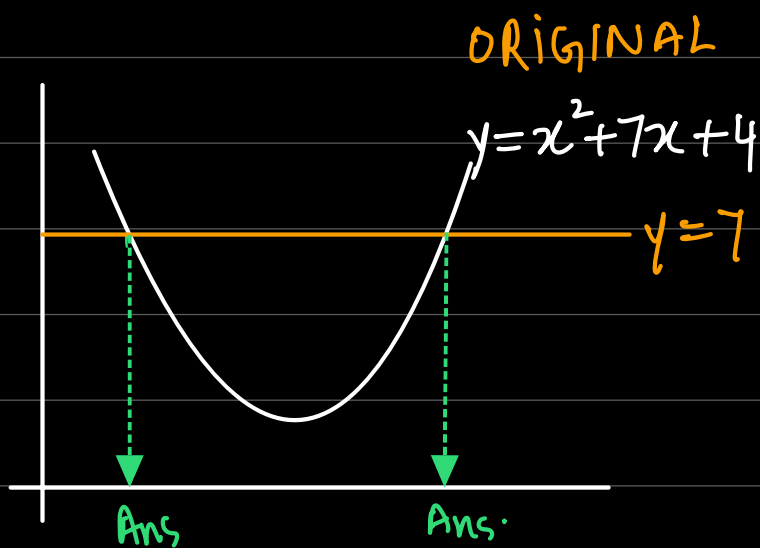
Step1: Make left hand side equal to original equation

Step2: Replace by y

Step3: Plot this line on your graph

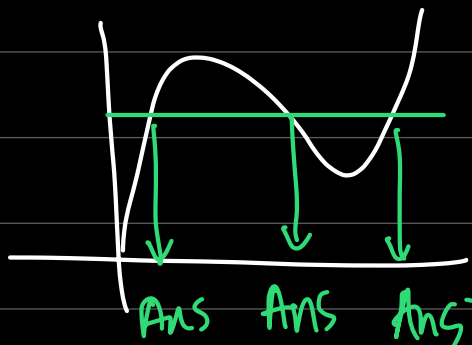
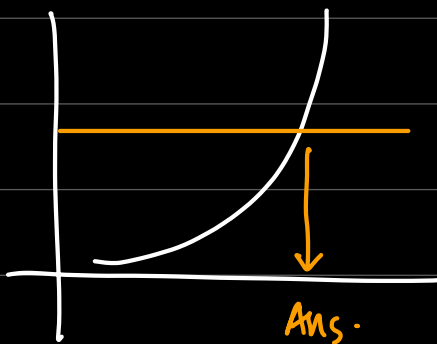
Step4: The x-axis values where the new line cuts the original graph are the final answers

(vi) Find using graph, solutions of $x^2 + 7x - 3 = 0$ (2 marks)

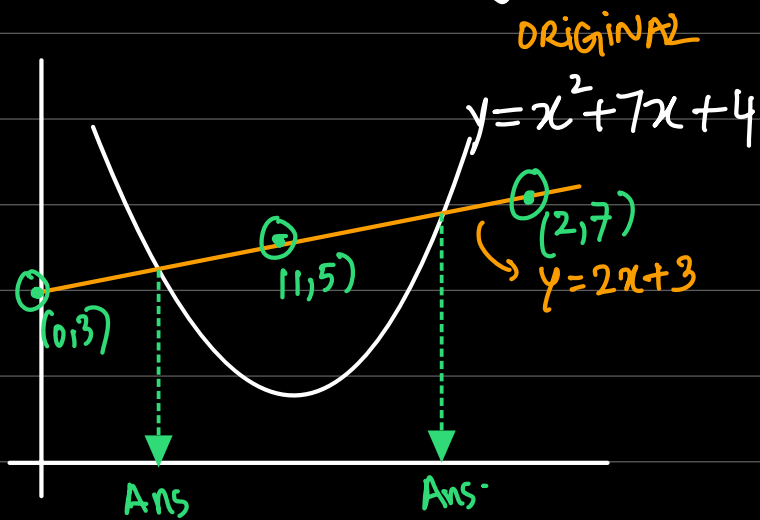


$$x^2 + 7x - 3 = 0$$

$$\begin{array}{r} \checkmark \quad \checkmark \quad +7 \quad +7 \\ \hline x^2 + 7x + 4 = 7 \\ y = 7 \\ \text{plot.} \\ \text{(HORIZONTAL)} \end{array}$$



(vii) Solve using graph, $x^2 + 5x + 1 = 0$ (2 marks)



$$y = 2x + 3$$

x	0	1	2
y	$2(0)+3$ 3	$2(1)+3$ 5	$2(2)+3$ 7

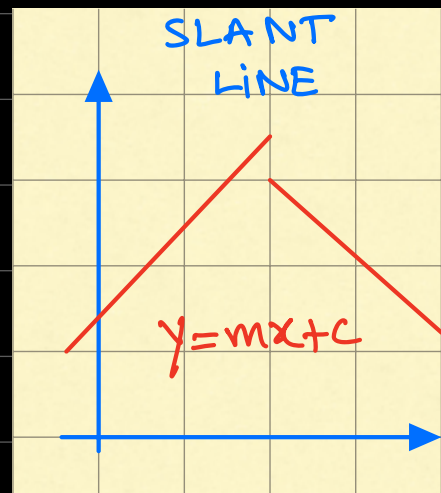
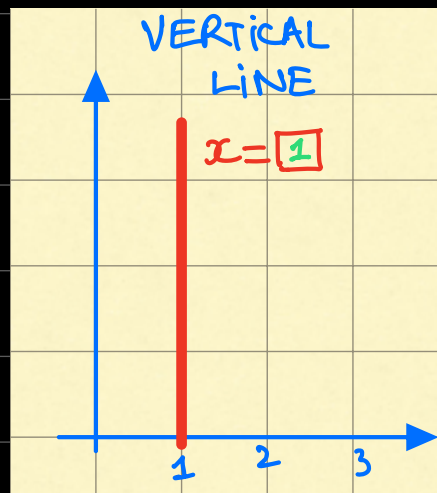
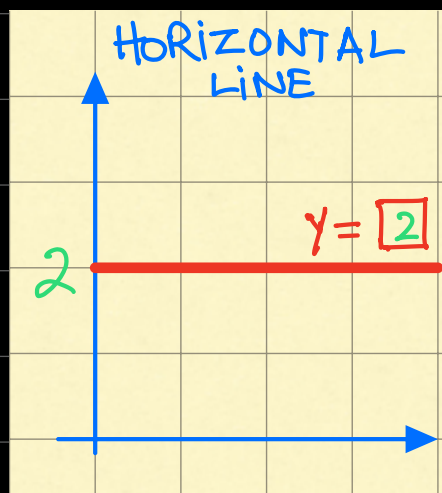
$$\begin{array}{r} x^2 + 5x + 1 = 0 \\ \checkmark + 2x + 3 \quad + 2x + 3 \\ \hline x^2 + 7x + 4 = 2x + 3 \end{array}$$

$$y = 2x + 3$$

plot: SLANT.

- Imp:
- 1) In case 1 x^2 and x^3 terms will always be same.
 - 2) For slant line, make a new box and take three values of x .

THIS IS USED IN 5-CHAPTERS:



- 1- Coordinate geometry.
- 2- Graphical Solutions
- 3- Shading Inequalities

- 4- Transformations
- 5- Kinematics.

CASE 2

KEYWORDS:

POINTS OF INTERSECTION
SOLUTIONS
SCARY EQUATION.

(viii) The points of intersection of curve $y = x^2 + 7x + 4$ and line $y = 2x + 5$ are solutions to $Ax^2 + Bx + C = 0$. Find values of A, B and C.

START OF THE QUESTION

Line

SCARY EQUATION (NO Y)

In case 2, you will always have three equations.

ORIGINAL (curve)
$y = x^2 + 7x + 4$

NEW (Line)
$y = 2x + 5$

SCARY (NO Y)
$Ax^2 + Bx + C = 0$

Method: Put the equation of curve and line equal.
Simplify and Compare to Scary Equation.

$$x^2 + 7x + 4 = 2x + 5$$

$$x^2 + 7x - 2x + 4 - 5 = 0$$

$$1x^2 + 5x - 1 = 0$$

$$Ax^2 + Bx + C = 0$$

$$A=1, \quad +B=+5, \quad +C=-1$$

$$B=5 \quad C=-1$$

(ix) The points of intersection of curve $y = x^2 + 7x + 4$ and line $y = x - 7$ are solutions to $Ax^2 + Bx + C = 0$. Find values of A, B and C. No y

ORIGINAL (curve)	=	New (Line)	SCARY (no y)
$y = x^2 + 7x + 4$		$y = x - 7$	$Ax^2 + Bx + C = 0$

$$x^2 + 7x + 4 = x - 7$$

$$x^2 + 7x - x + 4 + 7 = 0$$

$$1x^2 + 6x + 11 = 0$$

$$Ax^2 + Bx + C = 0$$

$$A=1, \quad B=6, \quad C=11$$

Now we know that in Case 2 we have three equation.

BASIC QUESTION:

Curve	Line	SCARY (no y)
ALWAYS GIVEN	GIVEN	MISSING

ADVANCED:

Curve	Line	SCARY (No Y)
ALWAYS GIVEN	MISSING	GIVEN.



When line is missing
we use $y = mx + c$ and
then start solving case 2.

- (x) The points of intersection of the curve $y = x^2 + 7x + 4$ and line L are solutions to $x^2 + 2x - 7 = 0$. Find equation of line L.
- $y = mx + c$
No Y (scary equation)

ORIGINAL (curve)	=	New (Line)	SCARY (No Y)
$y = x^2 + 7x + 4$		$y = mx + c$	$x^2 + 2x - 7 = 0$

$$x^2 + 7x + 4 = mx + c$$

$$x^2 + \underbrace{7x - mx} + 4 - c = 0$$

Now take common in x values only.

$$x^2 + (7-m)x + 4 - c = 0$$

$$x^2 + 2x - 7 = 0$$

$$(7-m)x = 2x$$

$$4 - c = -7$$

$$7 - m = 2$$

$$4 = c - 7$$

$$7 = m + 2$$

$$c = 4 + 7$$

$$m = 5$$

$$c = 11$$

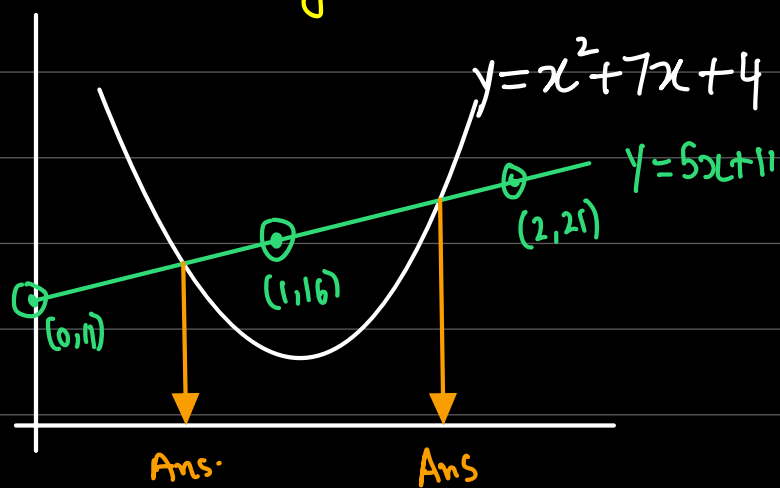
Line: $y = mx + c$

$$y = 5x + 11$$

(xi) Hence solve $x^2 + 2x - 7 = 0$.

Binding.

SCARY EQUATION



Line L: $y = 5x + 11$

x	0	1	2
y	$5(0) + 11$ 11	$5(1) + 11$ 16	$5(2) + 11$ 21

After Case 2, you will always be asked to solve SCARY EQUATION. Do not try to use Case 1.

Step 1: Plot line L from last part on graph.

Step 2: x-axis values where new line L cuts original graph are solution of SCARY equation.